Connecting Courses to Capstone

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How many of you had to do a senior thesis?

I won’t be talking about particular assessment tools or measures

I will be talking about what we are doing to make senior thesis more of a success - and that’s ongoing

The Setup

The Physics BS requires a Senior Thesis - an extended project over several months, documented in detail

This is our capstone - demonstrates mastery in written and oral communication, and depth in quantitative reason

This can be a springboard for their future careers - much more informative for graduate school applications and career interviews

and it should be fun!

(frog’s ears experiment)

Observations Using Department's 10in and 12in Diameter Telescopes

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Abstract

The focus of this research was to determine the field of view and the limiting magnitudes of the 10" and 12" diameter Meade telescopes of the University of the Pacific physics department. To accomplish this, images of the dual star system Mizar and Alcor and the star cluster M44 (the Beehive Cluster) were captured and analyzed. Using the dual star system, we can determine the field of view and resolution, and using the star cluster, we can determine the faintest stars that can be observed with each telescope, also known as the limiting magnitude. Knowing these values will simplify observations in future sessions since the limitations of the telescopes can be referenced to deduce whether or not a given object is observable based on its magnitude and apparent size. Additionally, a manual detailing the setup and calibration of the telescopes was created and tested.

experimental

Figure 8: Setup for Image Taking

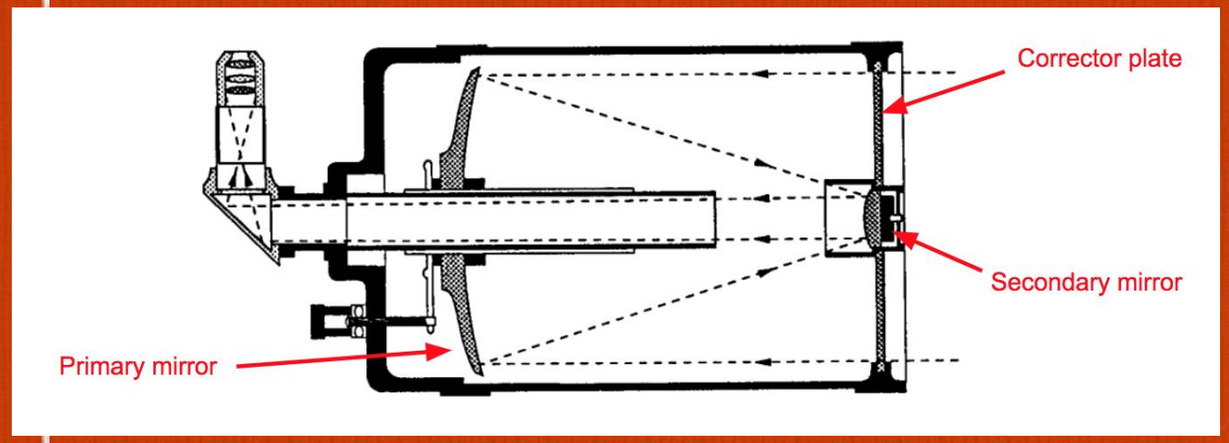

Figure 1: Schmidt-Cassegrain Labeled [3]

Figure 13: Simbad Image of M44

U(1) Lattice
Gauge Theory

Johnson Liu

Spring 2018

theoretical

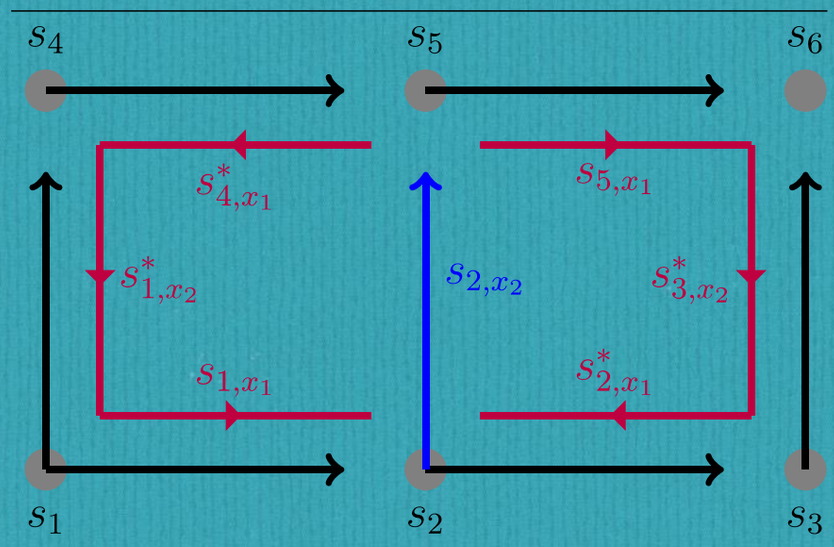

Figure 6: Staples on the lattice.

$$\mathscr{L}' = i\hbar c\bar{\psi}'\gamma^\mu\partial_\mu\psi' - mc^2\bar{\psi}'\psi'$$

$$\mathscr{L}' = i\hbar c\big(\psi^\dagger e^{-i\theta(x)}\gamma^0\big)\gamma^\mu\partial_\mu\big(e^{i\theta(x)}\psi\big) - mc^2\big(\psi^\dagger e^{-i\theta(x)}\gamma^0\big)\big(e^{i\theta(x)}\psi\big)$$

$$\mathscr{L}' = i\hbar c\psi^\dagger\gamma^0 e^{\frac{i\lambda(x)q}{\hbar c}}\gamma^\mu\Big(e^{-\frac{i\lambda(x)q}{\hbar c}}\partial_\mu\psi - \frac{iq}{\hbar c}e^{-\frac{i\lambda q}{\hbar c}}\partial_\mu\big(\lambda(x)\big)\psi\Big) - mc^2\psi^\dagger\gamma^0\psi$$

$$\mathscr{L}' = i\hbar c\bar{\psi}\gamma^\mu\partial_\mu\psi + q\bar{\psi}\gamma^\mu\psi\partial\lambda(x) - mc^2\bar{\psi}\psi\ . \tag{72}$$

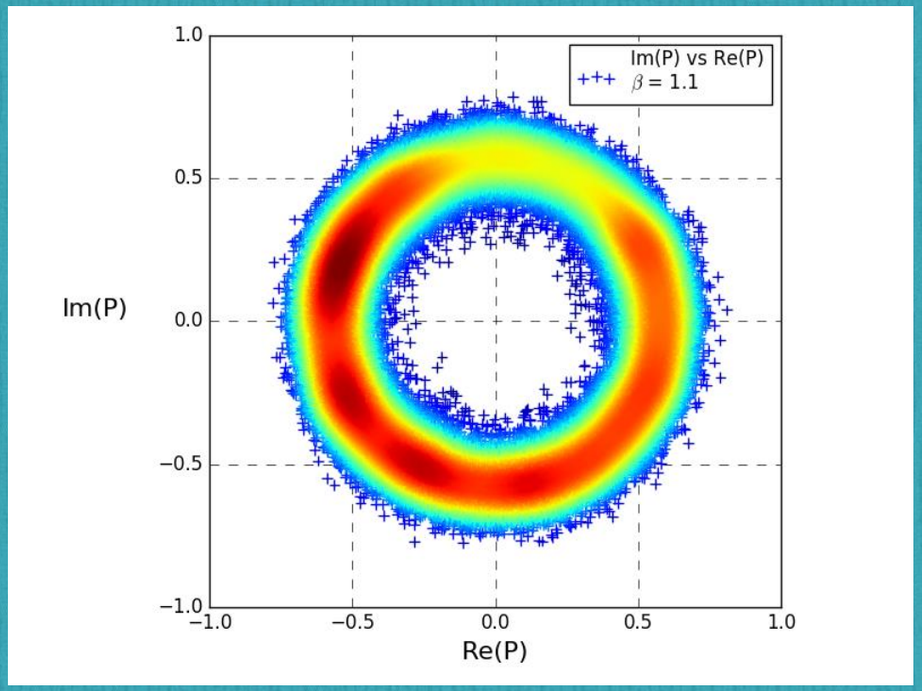

Figure 16: Im(Polyakov) versus Re(Polyakov) for $\beta = 1.1$.

The Problem - timing

It’s typically taken by seniors in their final semester:

1. do they have a project in time?

2. how recent is their scientific writing experience ?

3. can do they do something, write it up and present it in one semester ?

4. “senior-itis” - is it too close to the end of the major, motivation is dropping, ends up being less fulfilling ?

Is it really a problem?

Our own assessment of outcomes shows a broad range of success, from

(1) full mastery of a project, detailed technical writing, confident oral presentations, can answer questions well

to

(2) does enough in each category but doesn’t master any of them

is this just the usual spread among students?

are there structural issues e.g.

timing of courses

recency and depth of scientific writing

lack of coherent schedule for all seniors

Bachelor of Science in Physics **Course Path**

Students entering in EVEN years | Students entering in ODD years

Year	Sem.	Courses	Units	Total	NOTES
1st	Fall	PHYS 27 *Scientific Computing Tutorial*	1		
		MATH 51 *Calculus I*	4		
F		CHEM 24 *Chemistry for Engineers and Scientists* (w. Lab)	5		[*Can wait until Fall 2nd yr*]
r		PACS **I** *Pacific Seminar I*	4		
e		[*G. E. Course*]	4		[*Optional*]
s				14-18	
h	Spring	**MATH 53** *Calculus II*	4		
m		**PHYS 53** *Principles of Physics I* (w. Lab)	5		
a		COMP 51 *Intro to Programming*	4		Freshman Physics status
n		PACS **II** *Pacific Seminar II*	4		MATH 53 + PHYS 53
				17	
2nd	Fall	**MATH 55** *Calculus III*	4		
		PHYS 55 *Principles of Physics II* (w. Lab)	5		
S		G.E. Course	4		
o		G.E. Course	4		
p				14-18	
h	Spring	**MATH 57** *Differential Equations*	4		
o		**PHYS 57** *Modern Physics* (w. Lab)	4		
m		PHYS 197 *Undergrad Thesis*	1		[*Optional*] [*]
o		G.E. Course	4		Sophomore Physics Status
r		G.E. Course	4		MATH 57 + PHYS 57
e				17	Physics Core Completed
		EVEN years (2016,18,20,22,...) **ODD years (2015, 17, 19, 21,...)**			EVEN Fall: Mechanics Seq
3rd	Fall	PHYS 181 *Classical Mechanics* PHYS 101 *E & M*	4		ODD Fall: E&M Sequence
		PHYS 161 *Thermal Physics*	4		
J		G.E. Course	4		
u		G.E. Course / PHYS *Elective*	4		
n		PHYS 197 *Undergrad Thesis*	1		Begin Undergrad Thesis *
i				17	
o	Spring	**ODD years (2017, 19, 21, 23,...)** **EVEN years (2018, 20, 22, 24,...)**			
r		PHYS 183 *Quantum Mechanics* PHYS 102 *Electrodynamics*	4		
		PHYS *Elective*	4		
		G.E. Course	4		
		G.E. Course	4		
		PHYS 197 Undergrad Thesis	1		*
				17	
		EVEN years (2016,18,20,22,...) **ODD years (2015, 17, 19, 21,...)**			
4rd	Fall	PHYS 101 *E & M* PHYS 181 *Classical Mech*	4		
		PHYS 151 *Advanced Laboratory*			
S		G.E. Course	4		
e		G.E. Course / PHYS *Elective*	4		
n		PHYS 197 Undergrad Thesis	1		*
i				17	
o	Spring	**EVEN years (2016,18,20,22,...)** **ODD years (2015, 17, 19, 21,...)**			
r		PHYS 102 *Electrodynamics* *PHYS 181 Quantum Mech*	4		
		PHYS 197 *Senior Thesis*			
		PHYS *Elective*	4		
		PACS **III**	3		
				15	

The Physics BS layout

Advanced Laboratory

Senior Thesis

Advanced Laboratory:

Students examine experimental studies in modern physics, especially ones that require the design, construction and use of special apparatus. The course includes experiments in atomic, nuclear, and particle, optics, solid state physics and astrophysics are possible.

1. it’s a natural lead-in to Senior Thesis
2. the right skills in the 2nd to last semester - good timi
3. connection from course to capstone already there

To make it coherent:

Advanced Lab instructor (Dr Elisa Toloba) makes sure students have a thesis project already during Fall
i.e. a supervisor, an outline, get started on methodology and reading, give an introductory talk

This is not directly part of Adv Lab course, but becomes one of the program outcomes

better timing: graduate school applications due in Fall, senior thesis is too late to include, an active project in Fall means better recommendation letters and better student statements

different supervision:

each student has a mentor who's an expert for the project (typically connected to faculty's own research)

senior thesis director to manage overall schedule, pace of thesis writing, oral presentations, mandatory PURCC participation, more coherent across mentors

that role will rotate among faculty

how’s it going? assess!

this is our 2nd year with changes, so still new

1st year:

(a) logistics (e.g. scheduling talks) more challenging than expected

(b) balance student time between director and mentor

(c) quality of written work and oral presentations high

(d) mandatory PURCC participation very positive

final thoughts

are there other courses where we can make connection to the capstone more prominent?

is this specific to our program only?